

Midterm Exam #1 Study Guide

Midterm exam #1 is to be administered from 5 to 7 p.m. on September 30, 2008. The examination is to be comprehensive includes lectures, homework assignments and past in-class quizzes. The exam will be conducted in two parts: a closed-book section (about 40 minutes) and an open-book section (80 minutes). In the closed-book section, questions such as concepts, theories, and definitions will be employed. In the open-book section, problem analysis and calculation of specific property will be the focus. Below is a short list of chapter highlights to help you prepare for the examination.

Chapter 1 Overview of Mechanical Behavior

- Elastic vs. plastic deformation
- Linear elasticity vs. viscoelasticity
- Material work hardening behavior (K and n)
- Strain rate sensitivity
- Yielding under multiaxial loading (von Mises and Tresca yield criteria)
- Skip Mohr's Circle, pages 20-24

Chapter 2 Elastic Behavior

- Range of elastic moduli
- Major elastic properties (K , E , ν , G , σ , ϵ , γ)
- Linear elasticity, anisotropic linear elasticity, rubber elasticity
- Stiffness coefficients vs. compliance coefficients
- Bulk moduli of alkali metals (Figure 2.7) – what is its importance?
- Temperature effect on material behavior (Figure 2.11)
- Spring and dashpot models
- Mechanical damping

Chapter 3 Dislocations

- Edge and screw dislocations
- Slip mechanisms in edge dislocations (jog, climb, kink)
- Mixed dislocation motions
- Twinning (definition and mechanical behaviors)
- The interaction between a stress field and a dislocation and two dislocations
- Dislocation energies
- Partial dislocations
- Intersection of moving dislocations (Section 3.8 very important)
- Frank-Read sources, dislocation densities

Chapter 4 Plastic Deformation in Single and Polycrystalline Materials

- The relationship between critical resolved shear stress and yield stress
- Figure 4.2 Critical resolved shear stress and temperature curve with respect to strain rate effects
- Figure 4.4 Shear stress-shear strain curve
- Figure 4.7 shear stress-shear strain curves with temperature effect
- Plastic flow in polycrystals
- Crystal orientation and slip directions
- Table 4.1 is important – primary and secondary slip systems